AKDENIZ UNIVERSITY

Computer Engineering Department

CSE 211 Digital Design (2024-2025 Fall)

Lab03 – Gate Level Minimization – 04.11.2024

	Student No	Student Full Name	Group No
1			
2			
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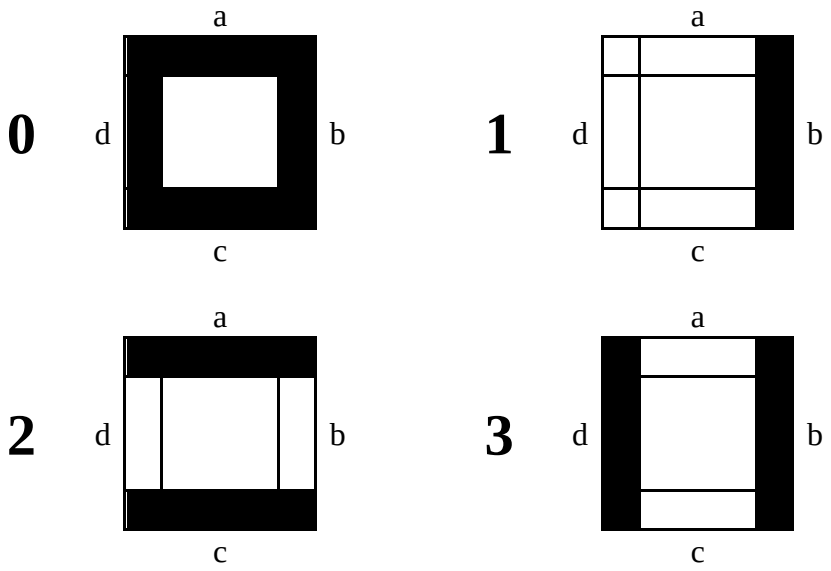
Lab Study 1 – *4 Segment Display*

Objective: Design a **4-segment display** that shows the numbers from 0 to 3 using four LEDs (labeled a, b, c, d). The display will be controlled by two binary inputs (A and B), where:

- A and B will represent the binary input values for decimal numbers 0-3.
- Each LED will either be on (black) or off (white) depending on the input combination.



- **Step 1 – Fill Out the Truth Table**

  Use the following truth table format to define the LED states for each input combination (A and B) that represents decimal values 0 to 3. Mark the output for each LED (a, b, c, d) based on the expected display state for each number.

Decimal Value	INPUTS		OUTPUTS (LED)			
	A	B	Led a	Led b	Led c	Led d
0	0	0				
1	0	1				
2	1	0				
3	1	1				

- **Step 2 – Derive Boolean Functions Using Karnaugh Maps**

  For each LED segment (a, b, c, d), derive the Boolean expression using K-maps to achieve the minimized logic.

Led a

A \ B	0	1
0		
1		

$F_a =$

Led b

A \ B	0	1
0		
1		

$F_b =$

Led c

A \ B	0	1
0		
1		

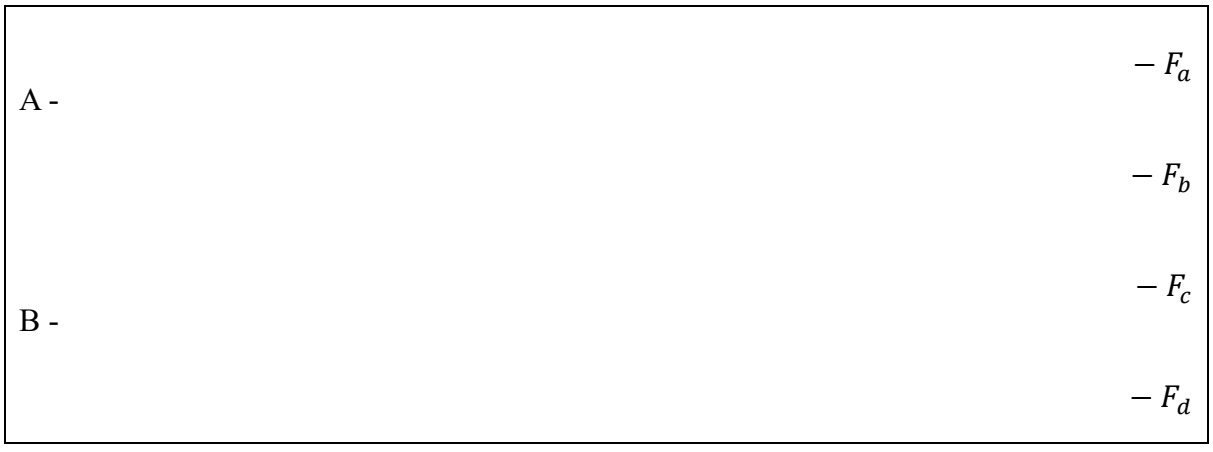
$F_c =$

Led d

A \ B	0	1
0		
1		

$F_d =$

- **Step 3 - Draw the circuit**



- **Step 4 - Implement and Test the Circuit**

  Use your Boolean expressions to create the circuit for each segment (a, b, c, d) on a breadboard. Instead of a,b,c,d you can use LEDs on the set (0,1,2,3). Then, test the circuit with all combinations of inputs (00, 01, 10, 11) to verify that the display accurately represents each number from 0 to 3.

Lab Study 2 - *Binary to LED Bar Graph Display*

Objective: Design a circuit that interprets binary input values (A, B, C) and displays them as a visual indicator on an 8-LED array, with each additional binary count lighting up one more LED. The truth table is given below.

	INPUTS			OUTPUTS (LEDs)							
	A	**B**	**C**	**7**	**6**	**5**	**4**	**3**	**2**	**1**	**0**
0	0	0	0	0	0	0	0	0	0	0	1
1	0	0	1	0	0	0	0	0	0	1	1
2	0	1	0	0	0	0	0	0	1	1	1
3	0	1	1	0	0	0	0	1	1	1	1
4	1	0	0	0	0	0	1	1	1	1	1
5	1	0	1	0	0	1	1	1	1	1	1
6	1	1	0	0	1	1	1	1	1	1	1
7	1	1	1	1	1	1	1	1	1	1	1

- **Step 1: Derive Boolean Functions Using Karnaugh Maps**
  For each LED segment (7,6,5,4,3,2,1,0), derive the Boolean expression using K-maps to achieve the minimized logic.

Led 7

A \ BC	00	01	11	10
0				
1				

$F_7 =$

Led 6

A \ BC	00	01	11	10
0				
1				

$F_6 =$

Led 5

A \ BC	00	01	11	10
0				
1				

$F_5 =$

Led 4

A \ BC	00	01	11	10
0				
1				

$F_4 =$

Led 3

A \ BC	00	01	11	10
0				
1				

$F_3 =$

Led 2

A \ BC	00	01	11	10
0				
1				

$F_2 =$

Led 1

A \ BC	00	01	11	10
0				
1				

$F_1 =$

Led 0

A \ BC	00	01	11	10
0				
1				

$F_0 =$

- **Step 2 - Draw the circuit**

A –

B –

C –

$-F_0$

$-F_1$

$-F_2$

$-F_3$

$-F_4$

$-F_5$

$-F_6$

$-F_7$

- **Step 3 – Implement and Test the Circuit**

  Use your Boolean expressions to create the circuit for each led on a breadboard. Then, test the circuit with all combinations of inputs.